International Journal of Agricultural
Science and Research (IJASR)
ISSN(P): 2250-0057; ISSN(E): 2321-0087
Vol. 7, Issue 1, Feb 2017, 377-384

TRANS STELLAR
•Journal Publications •Research Consultancy

EVALUATION OF THE ELITE CLONES OF KARI ISHADA MANGO (*MANGIFERA INDICA* L.) FOR THE MORPHOLOGICAL PARAMETERS OF THE FRUITS

SAMPATH. P. M.[1], NAGESH NAIK[2], SWAMY G. S. K.[3], LAXMAN KUKANOOR[4] & JAGDISH HIREMATH[5]

[1]*Department of Fruit Science, College of Horticulture UHS Campus, G.K.V.K (Post), Bangalore, Karnataka, India*

[2,3]*Department of Fruit Science, Kittur Rani Channamma College of Horticulture, Arabhavi, University of Horticultural Sciences, Bagalkot, Karnataka, India*

[4]*Department of Post Harvest Technology, Kittur Rani Channamma College of Horticulture, Arabhavi, University of Horticultural Sciences, Bagalkot, Karnataka, India*

[5]*Department of PSMA, Kittur Rani Channamma College of Horticulture, Arabhavi, University of Horticultural Sciences, Bagalkot, Karnataka, India*

ABSTRACT

The investigation was carried out to evaluate the morphological parameters of the elite clones of Kari Ishada mango variety in major growing parts of Uttara Kannada district. Among the 31 Kari Ishada trees selected in the present investigation, the fruit yield was highest in 'KIS-3' (624 kg/tree). The maximum fruit weight (477.25 g), peel weight (125.33 g), fruit length (101.05 mm) and fruit volume (465 ml) was found in 'KIS-25'. The maximum pulp weight (310.25 g), fruit width (100.95 mm), fruit thickness (92.17 mm), pulp percentage (69.56 %), pulp to stone ratio (7.89), fruit to stone ratio (11.28) and lowest stone percentage (9.05 %) was recorded in 'KIS-3'. The highest pulp to peel ratio (4.47), lowest peel weight (48.50 g) and lowest peel percentage (18.89 %) was found in 'KIS-17'. The stone weight was lowest in 'KIS-11' (29.00 g).

KEYWORDS: Kari Ishada, Fruit Yield, Fruit Weight, Pulp Percentage and Pulp to Stone Ratio

Received: Jan 02, 2017; **Accepted:** Jan 19, 2017; **Published:** Jan 30, 2017; **Paper Id.:** IJASRFEB201748

Original Article

INTRODUCTION

Mango (*Mangifera indica* L.) is one of the most important fruit crops of Anacardiaceae family that consists of dicotyledonous trees and shrubs. Mango originated as an allopolyploid from Eastern India, Assam and Burma (Popenoe, 1920). Mango has a large genetic diversity. When a cultivar is grown for a long period, though originated through vegetative propagation, variation may occur due to mutation at micro or macro level. Clonal variations are manifested many times in fruit characteristics besides other vegetative characteristics and yield attributes. Clonal selection within varieties can yield valuable results and hence, it is worth pursuing in countries where certain varieties are in cultivation for a long time. In mango, conventional methods of intravarietal heterogeneity identification are based on objective description of fruit and stone characteristics. The considerable variation exists among trees of the same clone in an orchard of mango with respect to fruit shape, size, colour. Morphological traits are subjective and visually evaluated in most cases. They can help in the identification and potential use of any genotype.

Kari Ishada is a popular mango variety cultivated in Uttara Kannada district of Karnataka. It is mainly grown in Ankola, Kumta, Honnavar and to a certain extent in Sirsi of the Uttara Kannada district. Kari Ishada is sweet and used for table purpose. Each panicle usually bears a single fruit only. Since it carries thick pulp, it is good for consumption. It is a famous variety for preparing a sweet drink locally called as 'Seekarni'.

Identification of superior elite clones is an important activity in the management of genetic resources in mango in the context of the present scenario of rapid extinction of such useful material. Still there is an immense potential of locating superior clones for collection, evaluation, conservation and utilization for the future crop improvement works. The present study aims to identify the superior clones of the Kari Ishada mango variety by the evaluation of their fruit morphology and quality parameters.

MATERIAL AND METHODS

An investigation on "Evaluation of the elite clones of Kari Ishada mango variety in major growing parts of Uttara Kannada district" was carried out. The elite clones of Kari Ishada mango of Ankola and Kumta regions of Uttara Kannada district were evaluated. The fruits were studied for morphological traits in the Department of Fruit Science, Kittur Rani Channamma College of Horticulture, Arabhavi, Karnataka state during 2015-16. A total of 31 clones were selected. Ten fruits per tree were collected and were replicated twice with five fruits per replication. The statistical design used was complete randomized design (CRD).

Ten fruits were collected from each of the selected elite trees from the farmers' field in villages of Ankola and Kumta. Twenty five trees from Ankola and six trees from Kumta were selected. The fruits were labeled after they were plucked from the tree. The weight of the fruit, pulp, peel and stone was recorded using electronic balance and expressed in grams. The length, width and thickness of fruit and stone were measured using digital vernier calipers and it was expressed in millimeters. The fruit volume was measured by the water displacement method and was expressed in milliliters.

Pulp (%)

The pulp percentage per fruit was calculated by following formula and expressed in percentage.

$$\text{Pulp (\%)} = \frac{\text{Pulp weight of fruit}}{\text{Total weight of fruit}} \times 100$$

Peel (%)

The peel percentage per fruit was calculated by following formula and expressed in percentage.

$$\text{Peel (\%)} = \frac{\text{Peel weight of fruit}}{\text{Total weight of fruit}} \times 100$$

Table 1: Tree Details of Kari Ishada Selections

Sl. No.	Tree	Place	Farmer Name
1	KIS-1	Bole, Ankola	Shailesh R. N.
2	KIS-2	Bole, Ankola	Shailesh R. N.
3	KIS-3	Bole, Ankola	Bellu Nayak
4	KIS-4	Bole, Ankola	Bellu Nayak
5	KIS-5	Bole, Ankola	Bellu Nayak
6	KIS-6	Bole, Ankola	Ganesh R.
7	KIS-7	Bole, Ankola	Nagaraj N.
8	KIS-8	Bole, Ankola	Naina nayak

Table 1: Contd.,			
9	KIS-9	Vandige, Ankola	Naina nayak
10	KIS-10	Vandige, Ankola	Venkatraman Raman.
11	KIS-11	Vandige, Ankola	Venkatraman Raman.
12	KIS-12	Jambugodu, Ankola	Shailesh R. N.
13	KIS-13	Seelya, Ankola	Subburaya Nayak
14	KIS-14	Seelya, Ankola	Rajesh S
15	KIS-15	Seelya, Ankola	Manohara S
16	KIS-16	Basugodu, Ankola	Laxman Beeran
17	KIS-17	Basugodu, Ankola	Laxman Beeran
18	KIS-18	Pujigeri, Ankola	Gopalakrishna H
19	KIS-19	Basugodu, Ankola	Balakrishna
20	KIS-20	Basugodu, Ankola	Vanitha Balakrishna
21	KIS-21	HRS Ichkada, Ankola	HRS
22	KIS-22	Ankola	Ganapathi Naraayan
23	KIS-23	HRS Ichkada, Ankola	HRS
24	KIS-24	Ankola	Venkatraman Nayak
25	KIS-25	Ankola	Venkatraman Nayak
26	KIS-26	Kagal Kumta	Honnayya H. Naik
27	KIS-27	Kagal, Kumta	Honnayya H. Naik
28	KIS-28	Kagal, Kumta	Honnayya H. Naik
29	KIS-29	Bada, Kumta	Devidas R
30	KIS-30	Bada, Kumta	Ganesh Vinayak
31	KIS-31	Bada, Kumta	Ganesh Vinayak

KIS: KARI ISHADA SELECTION

Stone (%)

The stone percentage per fruit was calculated by following formula and expressed in percentage.

$$\text{Stone (\%)} = \frac{\text{Stone weight of fruit}}{\text{Total weight of fruit}} \times 100$$

Pulp to Stone Ratio

The ratio of pulp to stone was calculated by the following formula

$$\frac{\text{Pulp}}{\text{Stone}} = \frac{\text{Pulp weight of fruit}}{\text{Stone weight of fruit}}$$

Fruit to Stone Ratio

The ratio of fruit to stone was calculated by the following formula

$$\frac{\text{Fruit}}{\text{Stone}} = \frac{\text{Fruit weight}}{\text{Stone weight}}$$

Peel to Pulp Ratio

The ratio of peel to pulp was calculated by the following formula

$$\frac{\text{Peel}}{\text{Pulp}} = \frac{\text{Peel weight of fruit}}{\text{Pulp weight of fruit}}$$

Statistical Analysis

The data on various characters were subjected to Fisher's method of analysis of variance and the interpretation of data as given by Panse and Sukhatme (1967). The level of significance used for 'F' and't' tests was p=0.05. Critical

difference (CD) values were calculated whenever the 'F' test was significant.

RESULTS AND DISCUSSIONS

Fruit Morphological Characters

The weight of fruit will have direct impact on the yield and productivity of the clone. Among the Kari Ishada selections, the fruit weight ranged from 237.50 g in 'KIS-20' to 477.25 g in 'KIS-25' (Table 2). This variation in fruit weight indicates the better chances for selection of this character. Similar results in fruit weight in the elite clones of Rumani (362.00 g), Neelum (404.20 g) and Bangalora (639.40 g) was reported by Ramaswamy (1989). Fruit weight of 121.00 g in 'Paiyur 1' (Vijayakumar *et al*., 1991); 516.00 g in 'Osteen' (Siller *et al.,* 1994); 252.00 g in 'SK007' (Chaikiattiyos *et al*., 2000) and 234.68 g in 'AA-5' (Mukunda, 2004) was reported. Moreover, the range of fruit weight from 178.00 g in 'BN Acc-8' to 474.00 g in 'BN Acc-25' (Begum *et al*., 2013); 130.00 g in 'CKR Acc-19' to 380.00 g in 'CKR Acc-29' (Begum *et al*., 2014) and 120.00 g in 'Pusa mango-7' to 510.00 g 'Pusa mango-2' (Singh *et al.,* 2015) was reported.

High pulp weight is a character which is essential for selection of the better genotypes in mango. The pulp weight among the Kari Ishada selections was found to be varied from 124.33 g in 'KIS-6' to 310.25 g in 'KIS-3' (Table 2). In the same manner, the pulp weight ranged from 76.05 g in 'CKR Acc-19' to 254.22 g in 'CKR Acc-29' (Begum *et al*., 2014) and 50.40 g in 'Pusa mango-7' to 392.70 g in 'Pusa mango-2' (Singh *et al.,* 2015).

Peel of the mango fruit accounts to non edible portion of the fruit. Hence, less peel weight is a desirable character in mango. The peel weight in the present study varied from 48.50 g in 'KIS-17' to 125.33 g in 'KIS-25' (Table 2). Likewise, the peel weight ranged from 29.90 g in 'CKR Acc-19' to 74.10 g in 'CKR Acc-29' (Begum *et al*., 2014) and 30.00 g in 'Pusa mango-1' to 80.00 g in 'Pusa mango-18' (Singh *et al.,* 2015). The fruit length showed variation among the selections which ranged from 73.12 mm in 'KIS-20' to 101.05 mm in 'KIS-25'. The fruit width varied from 69.62 mm in 'KIS-20' to 100.95 mm in 'KIS-3' and the fruit thickness was in a range of 67.41 mm in 'KIS-20' to 92.17 mm in 'KIS-3' (Table 2). The variation among the accessions of 'Baneshan' ranged between 8.00 cm in 'BN Acc-5' and 13.00 cm in 'BN Acc-25' for fruit length, 6.00 cm in 'BN Acc-14' to 9.10 cm in 'BN Acc-4' for fruit width and 5.00 cm in 'BN Acc-6' to 7.90 cm in 'BN Acc-16' for thickness (Begum *et al*., 2013) which is in conformity with the present study. Mukunda (2004); Begum *et al*. (2014); Singh *et al.* (2015) and Dinesh *et al.* (2015) also reported similar results. The variation in fruit length, fruit width and fruit thickness could not only be due to the genetic makeup of the clones but also due to the differential crop load and management of the trees under the study.

The fruit volume of Kari Ishada selections varied from 230.00 ml in 'KIS-2' to 465.00 ml in 'KIS-25' (Table 2). The clones of Alphonso also had the similar fruit volume of 227.34 ml in 'AA-5' (Mukunda, 2004).

Relative Content of the Fruit Parts

The mere pulp weight may not give the exact idea of edible portion present in the fruit. However, relative amount of the pulp gives better idea about the edible portion of fruit. The high pulp percentage, low peel percentage, low stone percentage and high pulp to stone ratio are the desirable characters in mango. Kaur *et al.,* (2014) reported the variation in pulp/stone ratio in mango from 1.80 in 'Local selection-1' to 7.29 in 'Langra Banarasi'. In the present study, pulp to stone ratio ranged from 2.53 in 'KIS-6' to 7.89 in 'KIS-3'. Pulp percentage varied between 49.68 per cent in 'KIS-9' and 69.56 per cent in 'KIS-3' (Table 3). This result is confirmed with the range of pulp contents of mango from 67.56 per cent in

'Bemcorado' to 83.21 per cent in

Table 2: Fruit Morphological Parameters of Kari Ishada Selections

Selections	Fruit Weight (g)	Pulp Weight (g)	Peel Weight (g)	Fruit Length (mm)	Fruit Width (mm)	Fruit Thickness (mm)	Fruit Volume (ml)
KIS-1	416.33	268.00	98.33	100.37	97.18	89.99	400.00
KIS-2	240.58	142.83	62.08	81.47	83.72	74.26	230.00
KIS-3	445.83	310.25	95.25	91.53	100.95	92.17	435.00
KIS-4	391.75	266.00	78.25	91.82	92.99	85.69	380.00
KIS-5	306.00	173.50	83.00	87.99	89.14	79.61	297.50
KIS-6	247.50	124.33	73.69	77.63	77.24	70.84	242.50
KIS-7	329.83	218.17	73.00	86.09	90.47	80.86	310.00
KIS-8	395.08	248.33	90.17	97.49	94.48	85.04	375.00
KIS-9	279.75	138.58	95.83	83.39	88.10	78.89	275.00
KIS-10	344.08	223.88	85.63	92.53	95.52	82.88	335.00
KIS-11	250.00	149.25	71.75	79.52	85.53	76.73	240.00
KIS-12	429.25	283.67	99.50	93.46	96.80	87.09	420.00
KIS-13	272.75	169.50	66.92	84.00	82.93	76.27	270.00
KIS-14	252.17	152.58	61.00	81.36	83.48	76.96	250.00
KIS-15	286.79	184.00	68.25	80.53	85.28	76.65	275.00
KIS-16	396.92	244.33	85.08	94.23	93.54	84.33	385.00
KIS-17	266.83	184.00	48.50	80.48	83.44	76.03	250.00
KIS-18	335.88	228.88	74.21	91.99	91.02	80.90	320.00
KIS-19	293.71	174.21	85.83	83.52	88.23	79.08	290.00
KIS-20	237.50	128.02	71.99	73.12	69.62	67.41	232.50
KIS-21	281.04	173.08	68.67	82.26	86.50	75.12	265.00
KIS-22	281.42	172.25	65.67	87.72	86.51	77.32	275.00
KIS-23	355.67	228.83	76.00	92.98	97.50	82.86	345.00
KIS-24	280.83	177.08	64.58	81.85	87.19	76.02	270.00
KIS-25	477.25	295.13	125.33	101.05	99.52	82.27	465.00
KIS-26	280.67	170.67	67.33	85.07	86.84	77.90	270.00
KIS-27	285.67	183.42	60.50	84.21	88.49	79.47	275.00
KIS-28	269.50	169.67	61.17	84.86	85.18	75.24	265.00
KIS-29	251.00	162.00	56.00	81.50	76.82	70.18	245.00
KIS-30	240.00	137.33	60.00	82.50	77.98	70.21	232.50
KIS-31	249.50	156.50	55.50	77.00	71.96	69.04	240.00
S.Em ±	21.75	17.64	6.90	2.13	2.53	1.82	19.47
C.D at 5%	62.73	50.87	19.90	6.13	7.29	5.25	56.15

Table 3: Relative Content of Pulp, Peel and Stone in Fruits of Kari Ishada Selections

Selections	Pulp (%)	Peel (%)	Stone (%)	Pulp to Stone Ratio	Fruit to Stone Ratio	Pulp to Peel Ratio
KIS-1	63.54	24.16	12.30	5.60	8.56	2.91
KIS-2	58.65	26.21	15.14	4.07	6.82	2.51
KIS-3	69.56	21.39	9.05	7.89	11.28	3.31
KIS-4	67.79	20.10	12.12	5.59	8.25	3.61
KIS-5	56.22	27.24	16.54	3.59	6.27	2.16
KIS-6	50.25	29.77	19.98	2.53	5.02	1.69
KIS-7	66.03	22.20	11.77	5.62	8.52	3.32
KIS-8	63.00	22.64	14.36	4.49	7.09	2.98
KIS-9	49.68	33.85	16.47	3.16	6.38	1.51
KIS-10	64.66	25.05	10.28	6.52	10.00	2.62
KIS-11	59.09	29.18	11.73	5.30	8.75	2.31
KIS-12	66.08	23.14	10.78	6.31	9.52	2.95
KIS-13	62.19	24.61	13.20	5.03	7.97	2.63

Table 3: Contd.,						
KIS-14	60.58	24.24	15.18	4.29	6.96	2.56
KIS-15	64.00	23.91	12.09	5.37	8.37	2.72
KIS-16	61.82	21.48	16.70	4.15	6.57	2.91
KIS-17	67.91	18.89	13.19	5.37	7.78	4.47
KIS-18	67.64	22.47	9.89	7.00	10.27	3.23
KIS-19	58.74	29.60	11.67	5.18	8.74	2.03
KIS-20	53.89	30.32	15.79	3.42	6.34	1.78
KIS-21	61.29	24.52	14.19	4.54	7.30	2.67
KIS-22	60.88	23.44	15.68	4.22	6.74	2.78
KIS-23	63.54	21.48	14.98	4.41	6.89	2.97
KIS-24	62.94	22.91	14.15	4.58	7.23	2.79
KIS-25	60.03	26.97	13.01	5.28	8.50	2.32
KIS-26	60.42	24.27	15.31	4.16	6.76	2.80
KIS-27	64.27	20.83	14.90	4.38	6.81	3.12
KIS-28	62.75	22.73	14.52	4.61	7.25	2.77
KIS-29	64.54	22.30	13.16	4.92	7.62	2.89
KIS-30	57.21	25.00	17.79	3.22	5.63	2.29
KIS-31	62.71	22.24	15.05	4.18	6.66	2.82
S.Em ±	2.37	1.66	1.37	0.56	0.64	0.32
C.D at 5%	6.84	4.80	3.96	1.60	1.85	0.92

Table 4: Stone Parameters of Kari Ishada Selections

Selections	Stone Weight (g)	Stone Length (mm)	Stone Width (mm)	Stone Thickness (mm)
KIS-1	50.00	70.27	43.28	24.28
KIS-2	35.67	59.72	37.95	21.47
KIS-3	40.33	63.47	38.86	23.98
KIS-4	47.50	63.26	40.41	26.20
KIS-5	49.50	64.38	39.84	25.95
KIS-6	49.49	59.08	35.51	21.10
KIS-7	38.67	60.70	38.15	23.90
KIS-8	56.58	73.74	42.39	23.92
KIS-9	45.33	61.61	38.87	29.15
KIS-10	34.58	64.20	38.13	23.48
KIS-11	29.00	60.49	36.25	20.75
KIS-12	46.08	72.10	39.98	24.30
KIS-13	36.33	61.04	37.23	21.10
KIS-14	38.58	61.28	39.04	25.63
KIS-15	34.54	63.38	36.02	22.84
KIS-16	67.50	75.30	40.92	25.31
KIS-17	34.33	62.39	37.41	20.83
KIS-18	32.79	64.39	37.42	22.28
KIS-19	33.67	62.66	38.04	18.07
KIS-20	37.50	48.81	33.25	18.49
KIS-21	39.29	59.10	36.99	22.83
KIS-22	43.50	65.06	38.20	24.22
KIS-23	50.83	66.93	38.49	24.73
KIS-24	39.17	59.18	36.56	22.85
KIS-25	56.92	69.80	42.08	25.19
KIS-26	42.67	65.37	38.70	23.13
KIS-27	41.92	65.90	40.43	22.97
KIS-28	38.67	61.23	38.50	28.79
KIS-29	33.00	55.57	35.96	22.48
KIS-30	42.67	56.70	37.99	21.00

Table 4: Contd.,				
KIS-31	37.50	55.95	36.50	20.50
S.Em ±	05.19	2.64	1.21	1.37
C.D at 5%	14.96	7.61	3.49	3.95

'RC-MS-1' (Desai and Dhandar, 2000); 53.80 per cent in 'BN Acc-8' to 78.10 per cent in 'BN Acc-21' (Begum *et al*., 2013); 54.30 per cent in 'CKR Acc-6' to 67.40 per cent in 'CKR Acc-29' (Begum *et al*., 2014) and 43.00 per cent in 'Pusa mango-7' to 77.00 per cent in 'Pusa mango-2' among the superior clones of mango (Singh *et al.,* 2015).

Stone Characters

The stone weight, stone length, stone width and stone thickness which account to the non edible portion of fruit should be minimum in mango fruits for the crop improvement. Among the Kari Ishada selections, the weight of stone was found to vary from 29.00 g in 'KIS-11' to 67.50 g in 'KIS-16' (Table 4). In similar trend, the stone weight ranged from 24.00 g in 'CKR Acc-29' to 56.77 g in 'CKR Acc-30' (Begum *et al*., 2014) and 24.00 g in 'Pusa mango 9' to 50 g 'Pusa mango 2' (Singh *et al.*, 2015).

The stone length of the selections varied from 48.81 mm in 'KIS-20' to 75.30 mm in 'KIS-16'. The stone width of the selections varied from 33.25 mm in 'KIS-20' to 42.39 mm in 'KIS-8. The stone thickness of the selections varied from 18.07 mm in 'KIS-19' to 29.15 mm in 'KIS-9' (Table 4). The similar variation was found for stone length (7.57 to 8.62 cm), stone width (3.52 to 3.93 cm) and stone thickness (2.22 to 2.57 cm) in the mango accessions characterized by Kheshin *et al.* (2016).

The variation in morphological parameters of the fruits and stones in the Kari Ishada selections may be attributed to the difference in genetic makeup of individual trees that are selected.

CONCLUSIONS

'KIS-3' is the best among the Kari Ishada selections with maximum pulp weight (310.25 g), fruit width (100.95 mm), fruit thickness (92.17 mm), pulp percentage (69.56 %), pulp/stone ratio (7.89), fruit/stone ratio (11.28) and lowest stone percentage (9.05 %).

REFERENCES

1. *Begum, H., Reddy, M. T., Malathi, S., Reddy, B. P., Narshimulu, G., Javaregowda, N. and Siddiq, E. A. (2013). Morphological and microsatellite analysis of intravarietal heterogeneity in 'Beneshan' Mango (Mangifera indica L.). Int. J. Biotechnol., **1**(1): 1-18.*
2. *Begum, H., Reddy, M. T., Malathi, S., Reddy, B. P., Narshimulu, G., Javaregowda, N. and Siddiq, E. A. (2014). Morphological and microsatellite analysis of intravarietal variability in 'Cherukurasam' cultivar of Mango (Mangifera indica L.), Jordan J. Agric. Sci., **10**(3): 452-472.*
3. *Chaikiattiyos, S., Kurubunjerdjit, R., Akkaravessapong, P., Rattananukul, S., Chueychum, P. and Anupunt, P. (2000). Improvement and evaluation of the selected 'Kaew Sisaket' mango in Thailand. Acta Hort., **509**:185-192.*
4. *Desai, A. R. and Dhandar, D. G. (2000). Variation in physico-chemical and morphogenetic characters of some mango varieties of Goa. Acta Hort., **509**: 243-249.*

5. *Dinesh, M. R., Ravishankar, K. V., Sthapit, B., Parthasarathy, V. A., Sandya, B. S., Nischita, P. and Lavanya, B. (2015) Genetic diversity studies in certain indigenous mango (Mangifera indica L) varieties. Indian J. Plant Gen. Resour., 28 (1): 153-160.*

6. *Kaur, M., Bal, J. S., Sharma, L. K. and Bali, S. K. (2014). An evaluation of mango (Mangifera indica L.) germplasm for future breeding progrmme.* African J. Agric. Res*.,* ***9****(20): 1530-1538.*

7. *Kheshin, M. A., Hossam, A. S. and Abdou, M. A. (2016) Morphological and molecular analysis of genetic diversity among some 'Sukkary' mango (Mangifera indica L.) Genotypes. J. Hort. Sci. Orn. Plants,* ***8*** *(1): 01-10.*

8. *Mukunda, G. K. (2004). Studies on the performance of certain clones of mango (Mangifera indica L.) cv. Alphonso. PhD Thesis, Uni. Agric. Sci., GKVK, Bangalore, India.*

9. *Panse and Sukhatme, P. V. (1967). Statistical methods for Agricultural workers. Indian council of Agricultural Research, New Delhi.*

10. *Popenoe, W. (1920). Manual of Tropical and Subtropical Fruits, MacMillan, New York, USA.*

11. *Ramaswamy, N. (1989). Survey and isolation of 'plus trees' of mango. Acta Hort.,* ***231****: 93-96.*

12. *Siller, C. J, Muy, R. D., Araiza, E., Baez, M., Rodriguez, J, Baez, R., Ireta, A. and Campbell, R. J. (1994). Evaluation of the quality of mango clones introduced to Sinaloa. American Soc. Trop. Hort.* ***38****: 37-42.*

13. *Singh, S. K., Singh, A., Nath, V., Parthasarathy, V. A., Sthapit, B., Rajan, S. and Vinoth, S. (2015). Genetic Diversity in Seedling Populations of Mango. Indian J. Plant Gen. Resour.,* ***8****(1): 123-131.*

14. *Vijayakumar, M., Ramaswamy, N. and Rajagopalan, R. (1991). Exploiting natural variability in mango. Proc. Natl. Seminar on Irregular bearing in Mango - Problems and Strategy, Pusa, Bihar, India: 55-56.*